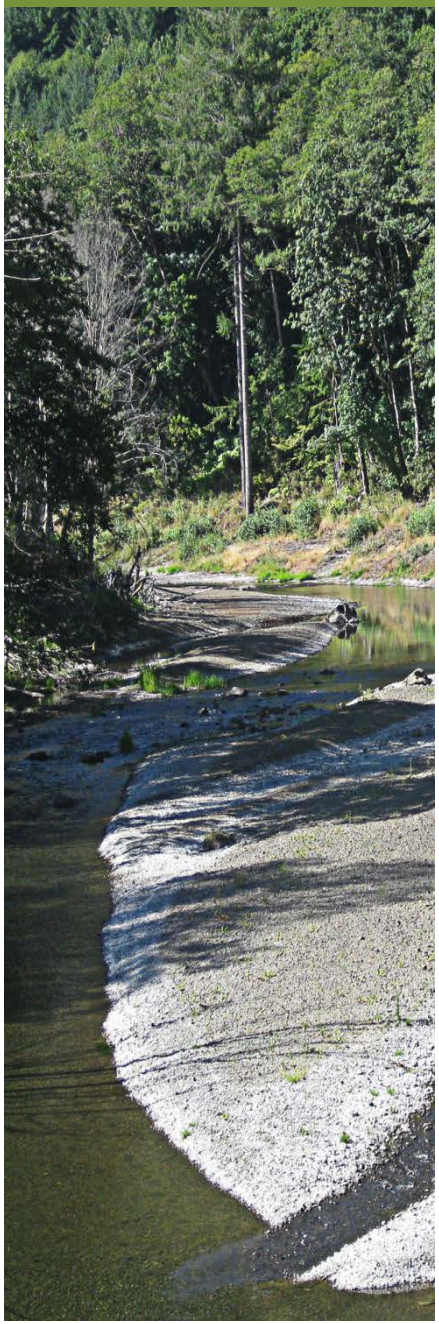
Chehalis Basin Strategy: Reducing Flood Damage and Restoring Aquatic Species

Pe Ell Public Meeting

October 14, 2014



History of Flood Damage

March 1910

December 1933

January 1974

November 1990

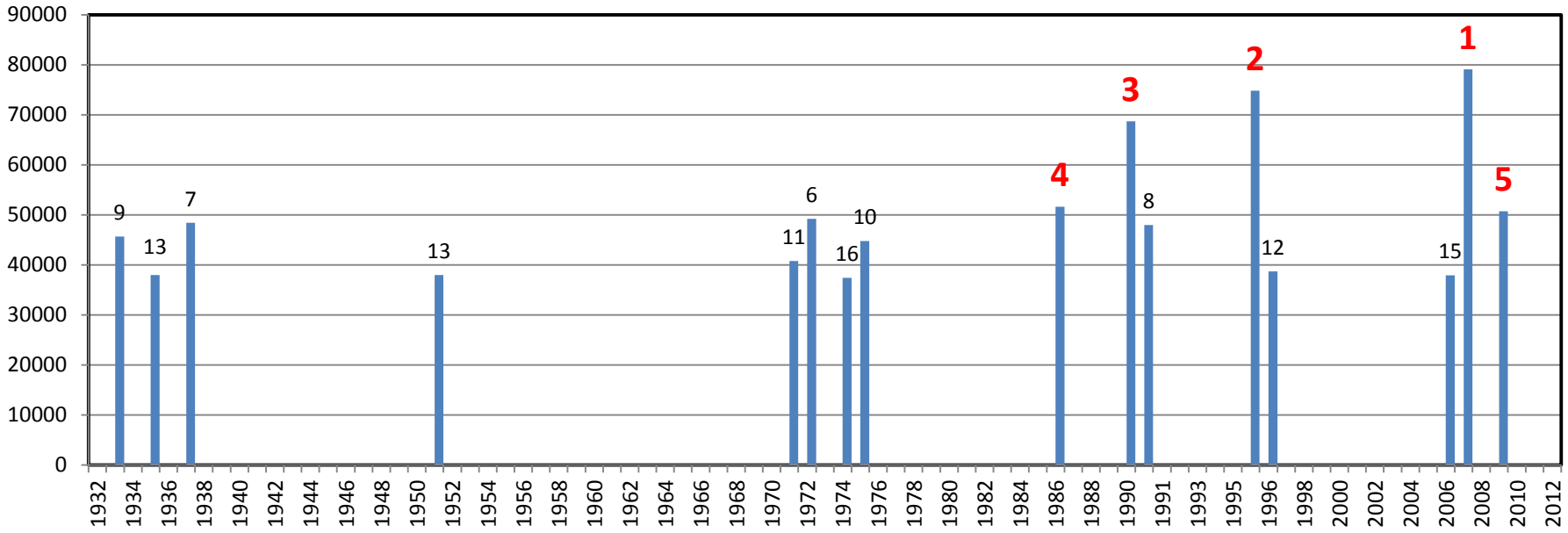
RANKED HIGH-FLOW EVENTS:

Chehalis River Flow Rates near Grand Mound (cubic ft./sec.)

Interstate 5 closed 1990, 1996, 2007, 2009

Five largest events have all occurred since 1986 -- Frequent floods are getting worse and damage is increasing . . .

100 year flood estimate increased 33% in last 30 years.



Salmon Declines

- Salmon populations are 15-25% of historic levels.

Upper Chehalis (5/31/2010)
JAMES E. WILCOX / WILD GAME FISH
CONSERVATION INTERNATIONAL

www.chehalisbasinpartnership.org

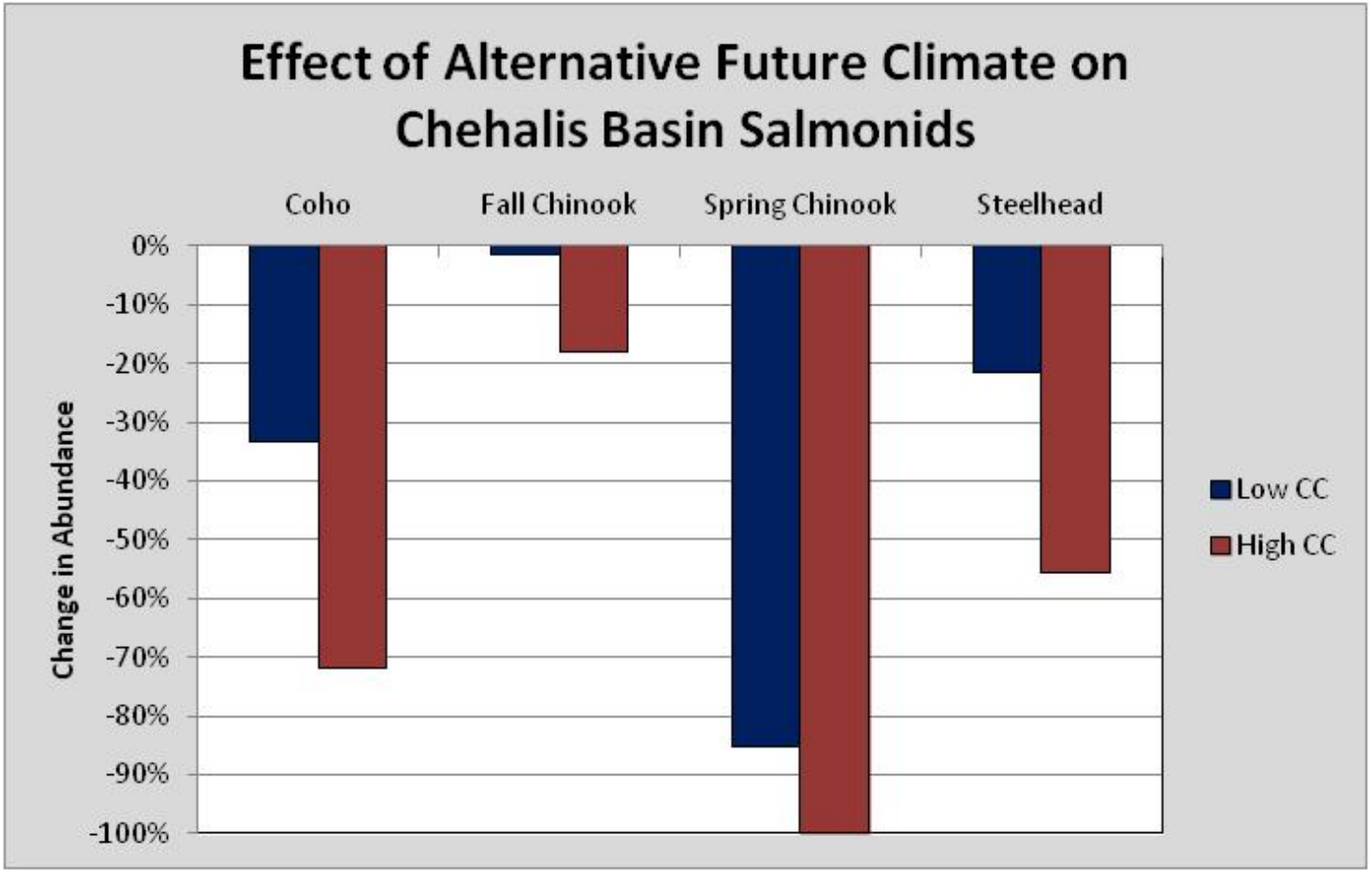
Potential Changes: Flooding and Habitat Degradation

- The amount of climate change is uncertain.
- The predicted change ranges used are an 18 to 90 percent increase in flooding.
- Drier, hotter summers, lower summer flows and higher water temperatures.

Change in 100-year Flows and Water Levels

	Baseline	With 18% Climate Change	With 90% Climate Change
Flow at Grand Mound (cfs)	75,500	91,350	162,900
Water Surface Elevation Upstream of Mellen Street (feet NAVD)	178.1	179.8	184.3

Climate Change

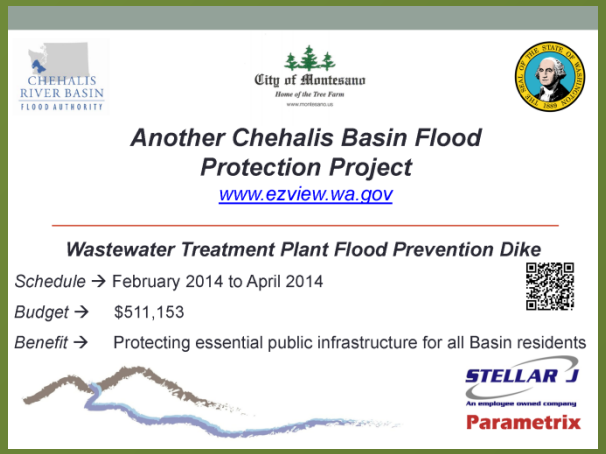


Changing the Long History of Political Failure

- No action since 1933.
- More than 830 studies.
- Today action is happening . . .

Aquatic Species Surveys, 2013

Adna Levee, 2013



Montesano WWTP, 2014

Airport Levee, 2014

CHEHALIS RIVER BASIN FLOOD AUTHORITY

- Grays Harbor County
- City of Aberdeen
- City of Cosmopolis
- City of Montesano
- City of Oakville
- Lewis County
- City of Centralia
- City of Chehalis
- City of Napavine
- Town of Pe Ell
- Thurston County
- Town of Bucoda

CHEHALIS RIVER BASIN FLOOD AUTHORITY

Current Projects Underway in the Chehalis Basin

GRAYS HARBOR COUNTY

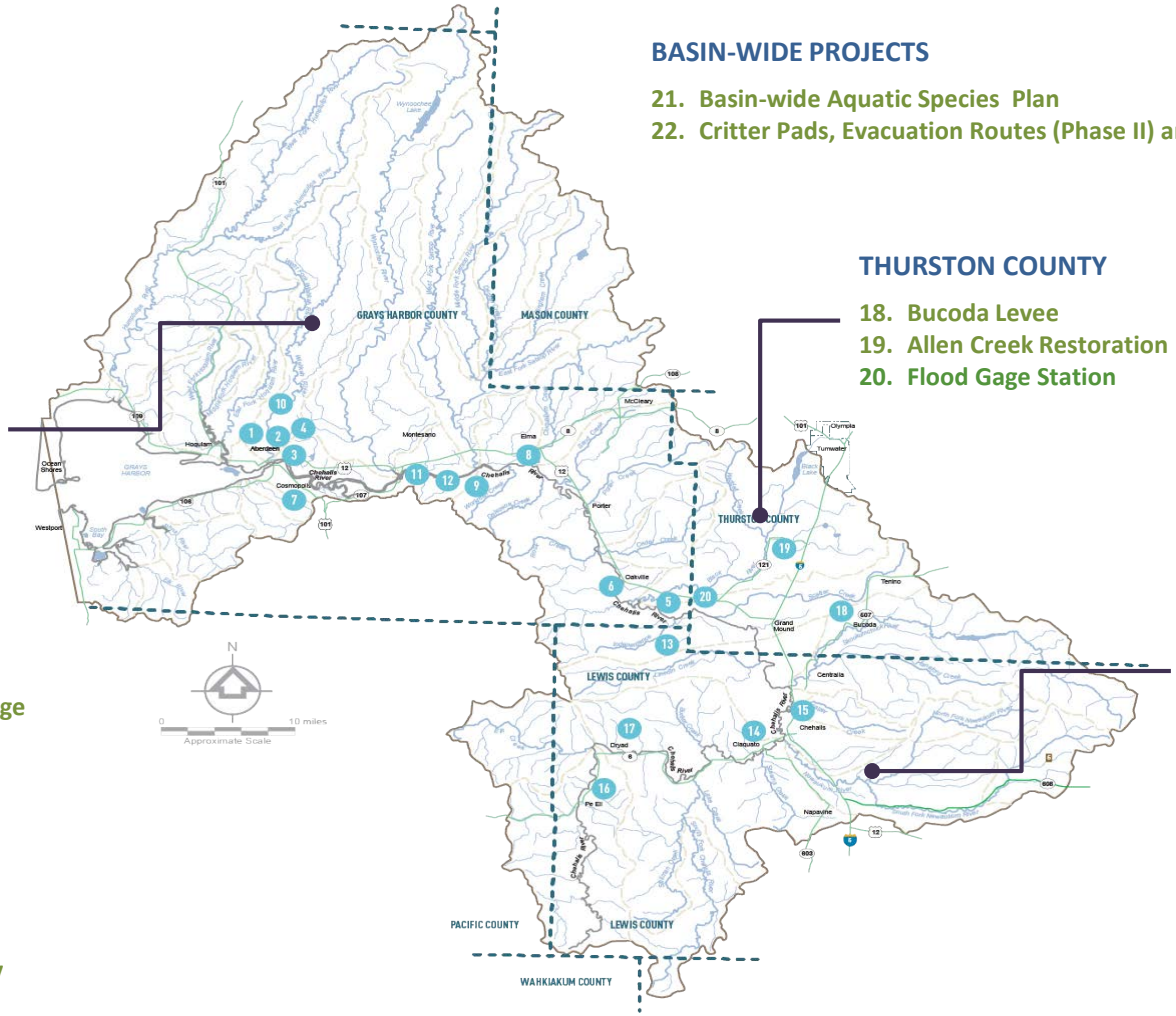
1. Burger King Trail/Dike
2. Dike Bank of Wishkah North of Highway
3. Market Street Dike
4. Southside Dike/Levee Certification
5. Oxbow Lake Reconnection
6. Sickman-Ford Overflow Bridge
7. Mill Creek Dam Improvement
8. Elma-Porter Flood Mitigation
9. Satsop River Floodplain Restoration (Phase I)
10. Wishkah Road Flood Levee
11. Revetment for Montesano Road, Sewage Treatment
12. Satsop River Floodplain Restoration (Phase II)

BASIN-WIDE PROJECTS

21. Basin-wide Aquatic Species Plan
22. Critter Pads, Evacuation Routes (Phase II) and Geomorphic Analysis

THURSTON COUNTY

18. Bucoda Levee
19. Allen Creek Restoration
20. Flood Gage Station



LEWIS COUNTY

13. Oxbow Reconnection at RM 78
14. Adna Levee
15. Airport Levee (Phase I)
16. Wastewater Treatment Plant Flood Prevention
17. Critter Pads, Evacuation Routes (Phase I)

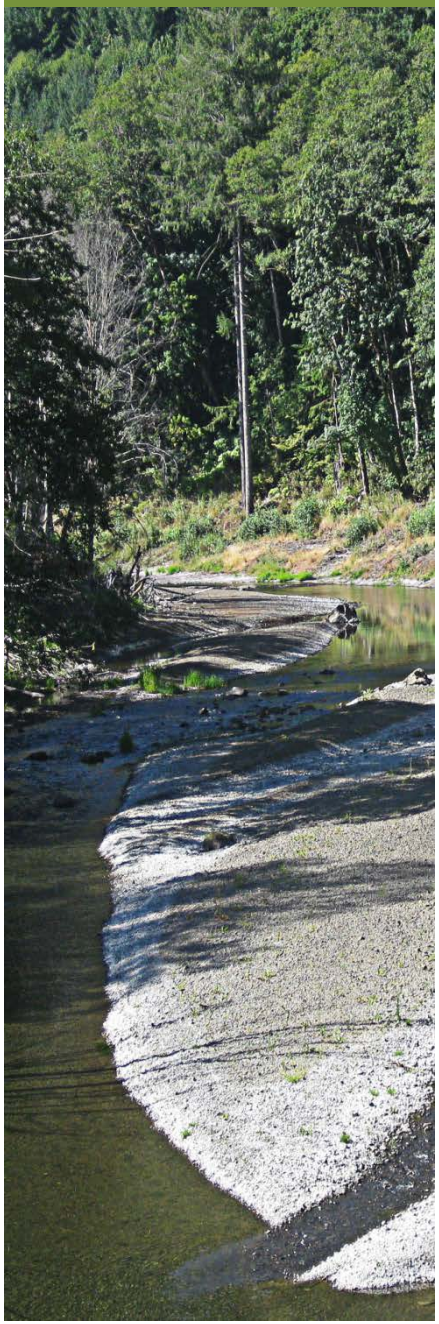
STATUS: Finished / Underway

Governor's Chehalis Basin Work Group

- Tasked by Governor to recommend long-term strategy and budget for next biennium to reduce flood damage and enhance aquatic species.
- Recommendations due mid-November.

- Members are:
  - David Burnett (Chairman Chehalis Tribe).
  - Karen Valenzuela (Thurston County Commissioner, Vice-Chair Flood Authority).
  - Vickie Raines (Mayor Cosmopolis, Chair Flood Authority).
  - J. Vander Stoep (Private Attorney, Pe Ell Alternate Flood Authority).
  - Jay Gordon (President Washington Dairy Federation and Chehalis Farmer).
  - Rob Duff (Governor's Natural Resource Advisor).
  - Keith Phillips (Governor's Energy and Environment Advisor).

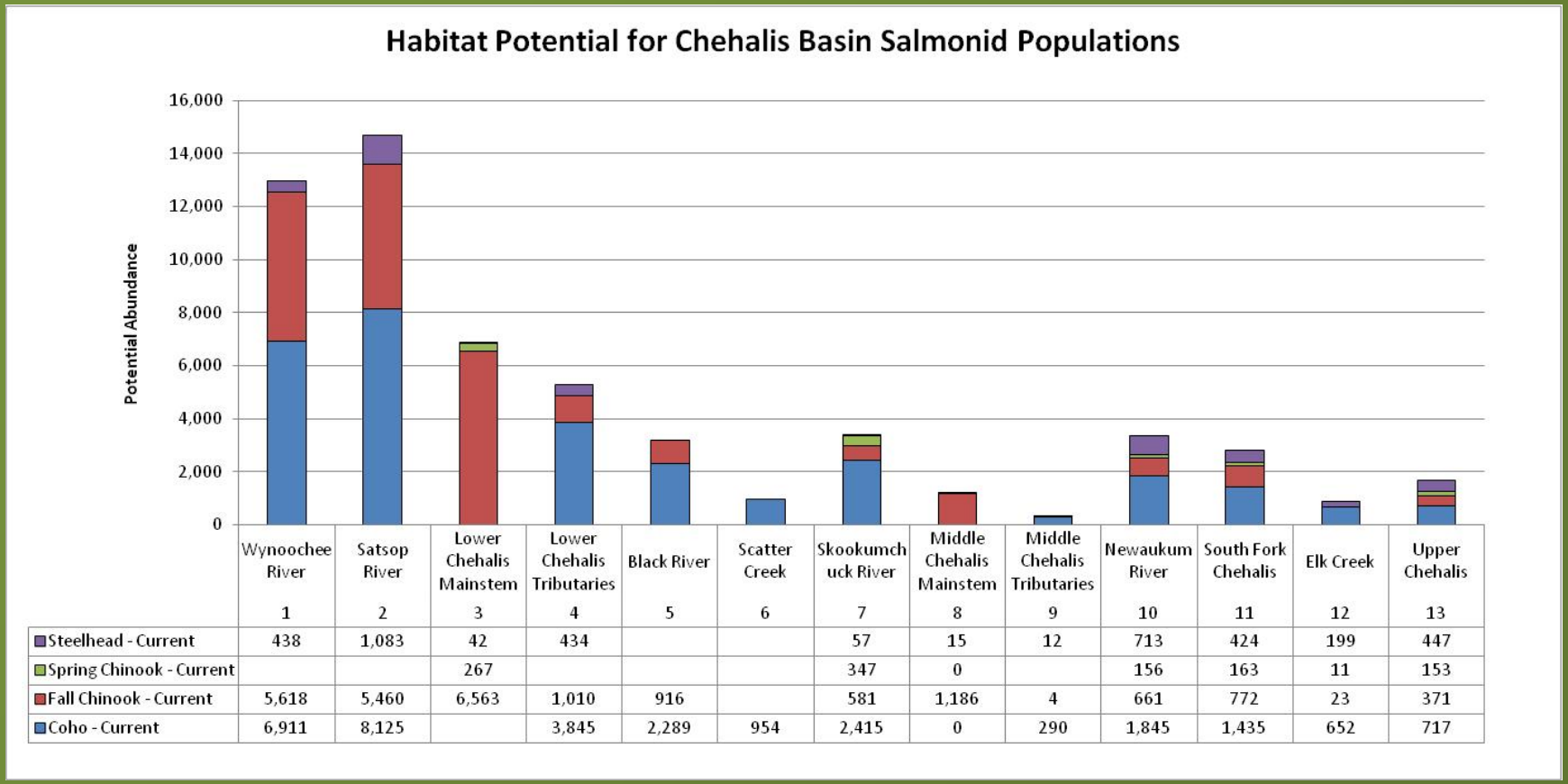
Restoring Aquatic Species



Salmon – Habitat Potential

Species	Current Spawner	Habitat Degradation
Spring Chinook Salmon	2,300	78%
Fall Chinook Salmon	9,600	45%
Coho Salmon	42,000	69%
Winter-run Steelhead	8,700	44%

Existing Salmon Habitat Potential by Sub-Population

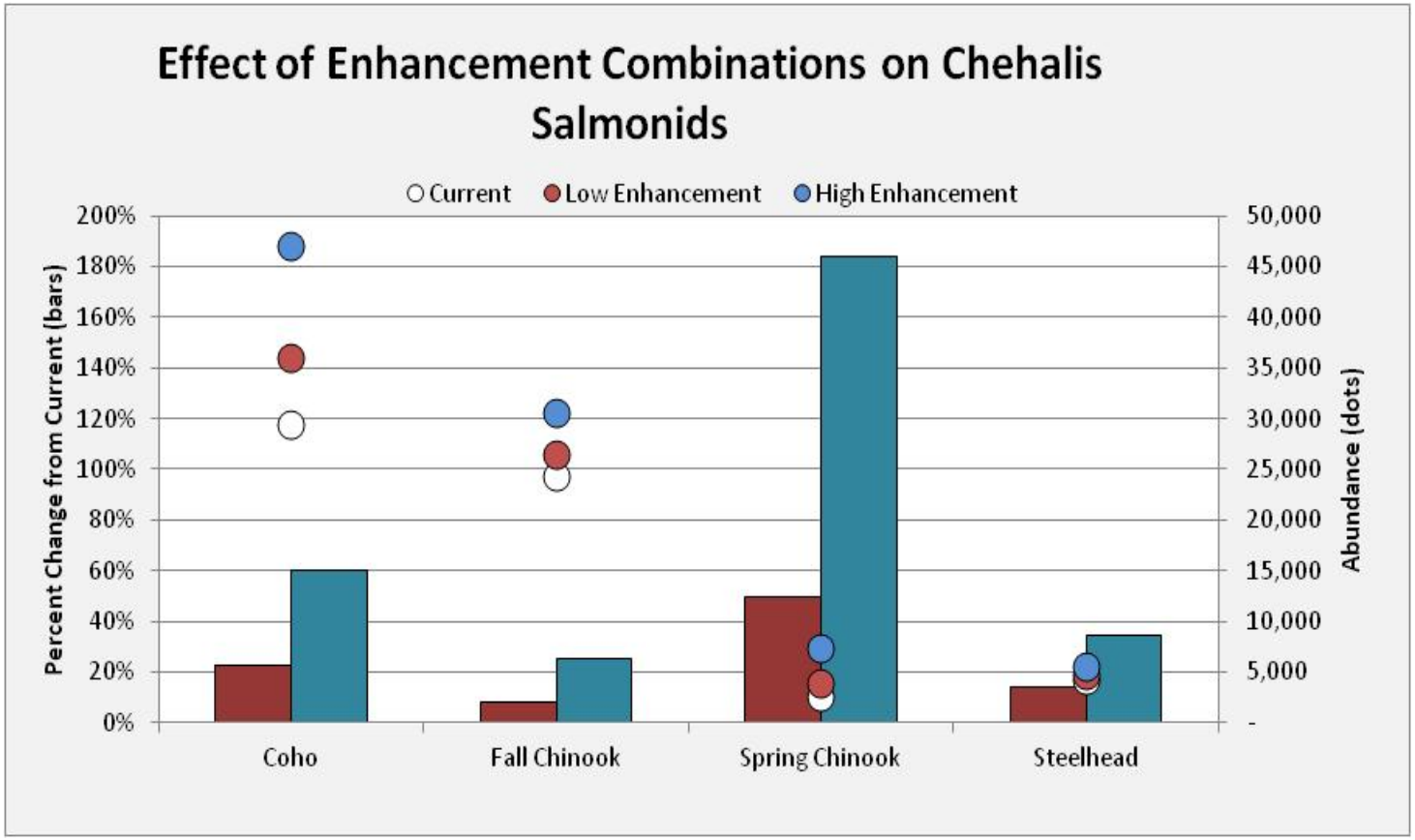


	Wynoochee River 1	Satsop River 2	Lower Chehalis Mainstem 3	Lower Chehalis Tributaries 4	Black River 5	Scatter Creek 6	Skookumchuck River 7	Middle Chehalis Mainstem 8	Middle Chehalis Tributaries 9	Newaukum River 10	South Fork Chehalis 11	Elk Creek 12	Upper Chehalis 13
Steelhead - Current	438	1,083	42	434			57	15	12	713	424	199	447
Spring Chinook - Current			267				347	0		156	163	11	153
Fall Chinook - Current	5,618	5,460	6,563	1,010	916		581	1,186	4	661	772	23	371
Coho - Current	6,911	8,125		3,845	2,289	954	2,415	0	290	1,845	1,435	652	717

Habitat Restoration Actions

1. Remove barriers to fish passage (culverts) – benefit to coho, steelhead and fall Chinook (not spring Chinook)
2. Benefits from Forest Practice regulations – all stocks
3. Riparian enhancement to restore 50 and 70 percent of Spring Chinook spawning reaches outside of managed forests, 90 to 125 miles.
4. Two levels of effectiveness evaluated.

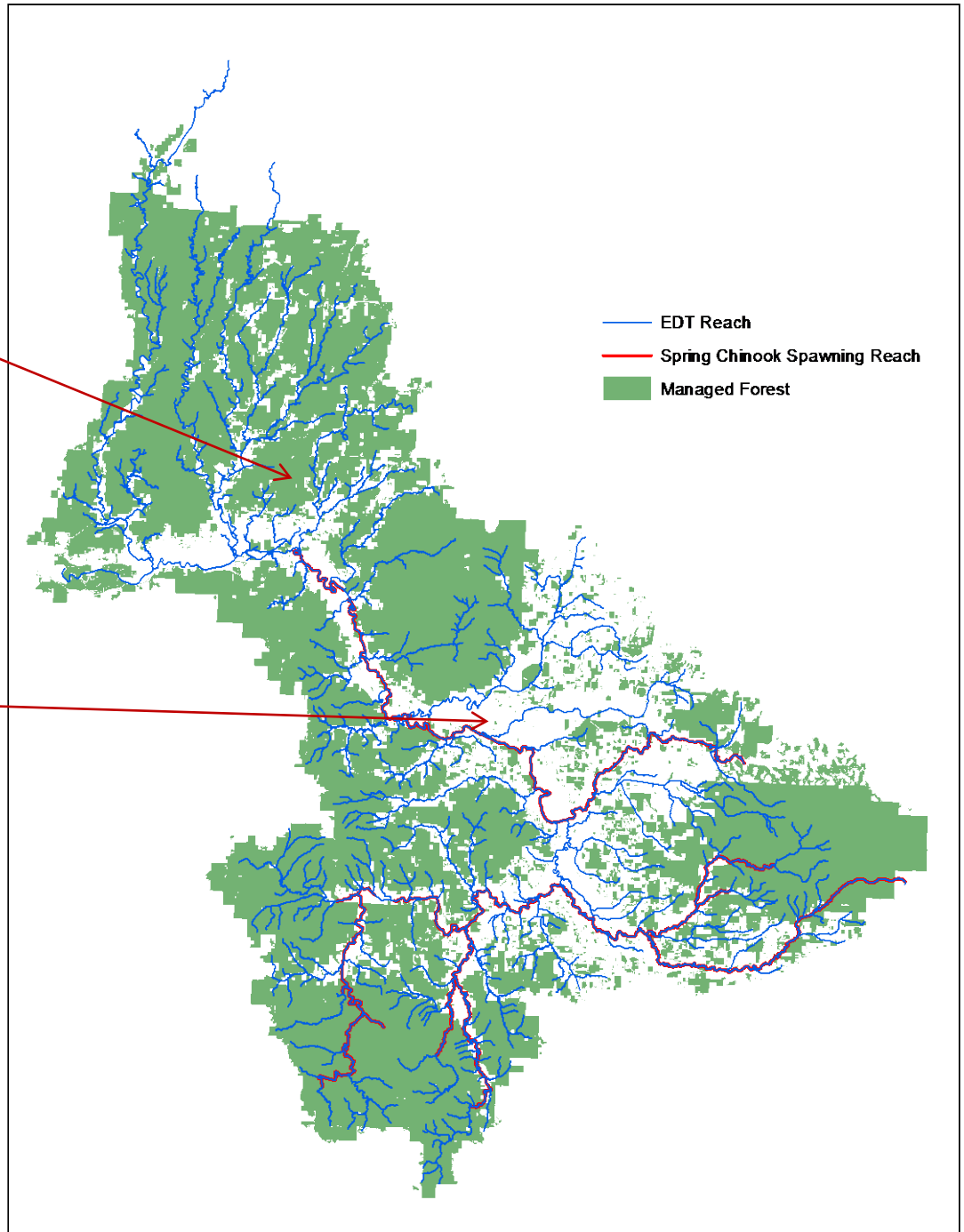
Results: Habitat Enhancement Combinations



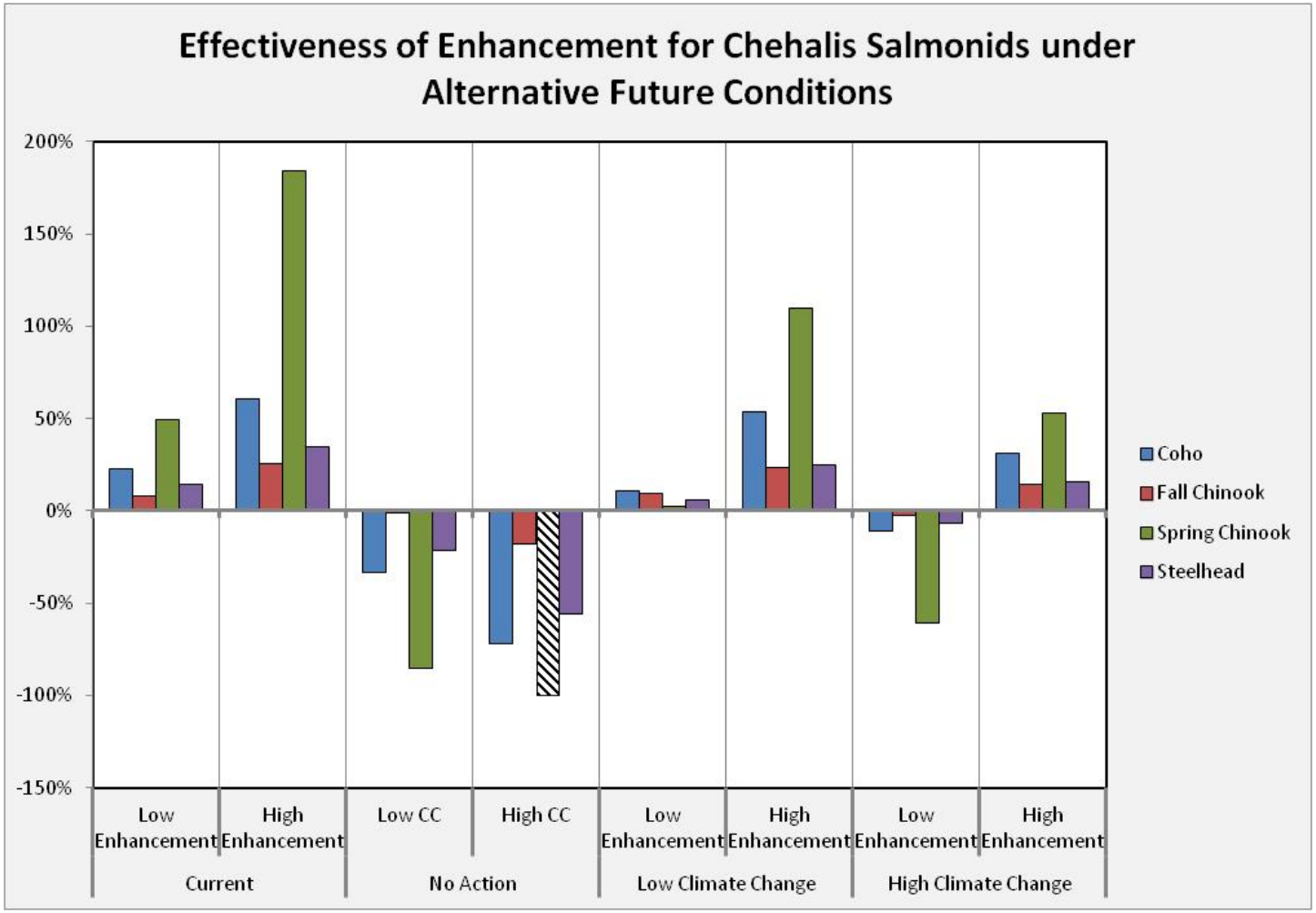
Bars: % change in abundance relative to current condition (left axis)

Dots: Abundance of fish (right axis)

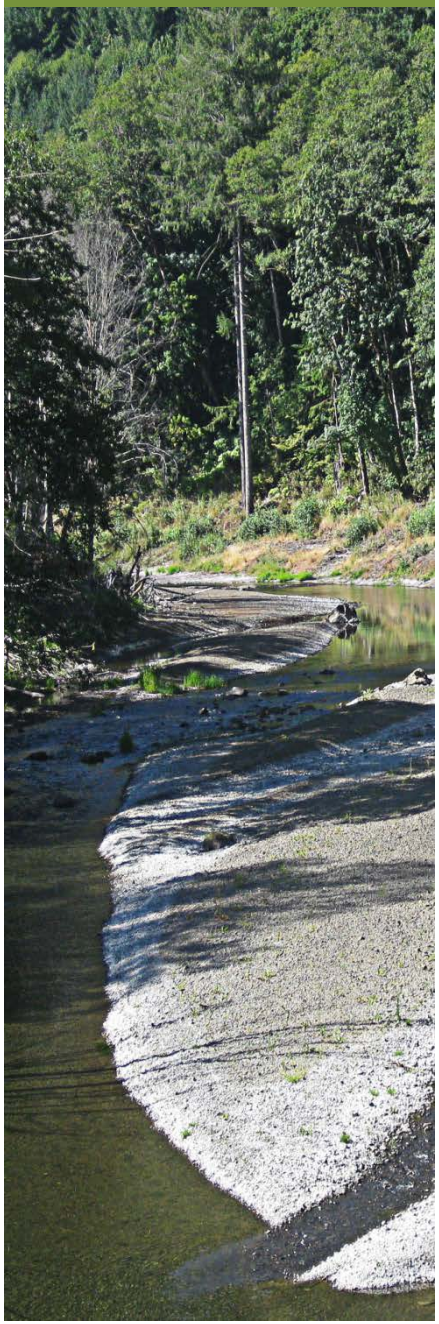
Enhancement Can Increase Salmon Populations By 50%



Enhancement + Climate Change (Basin Scale)



Reducing Flood Damage



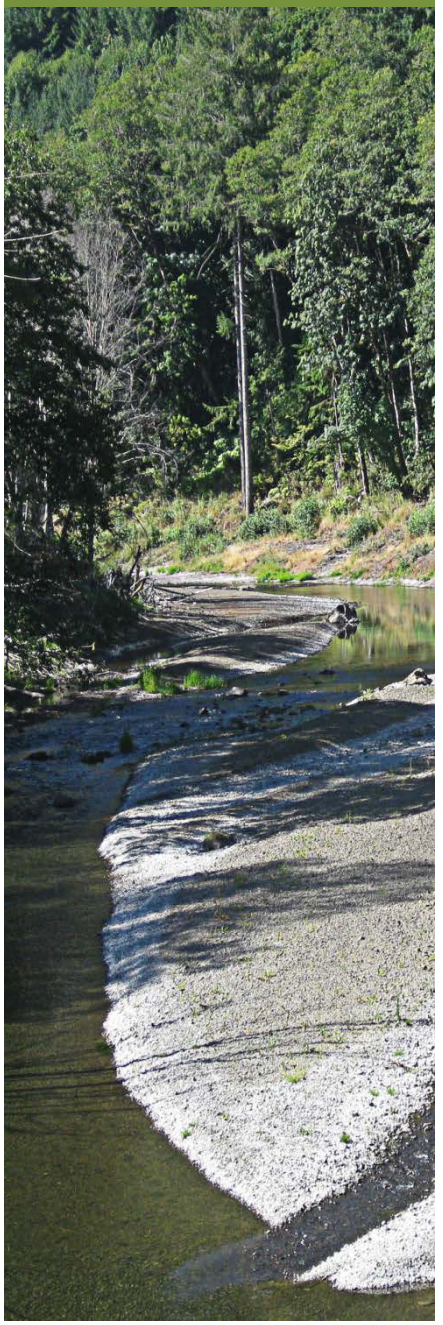
Past Analyses

- Levees
- Dredging
- Multiple Storage Options
- Relocation
- Floodplain reconnection
- By-pass channels

Reducing Flood Damage - Feasibility Analyses

- Protection of I-5 with walls and levees.
- Floodproofing and Small Projects.
- Land Use Management.
- Water Retention Feasibility.

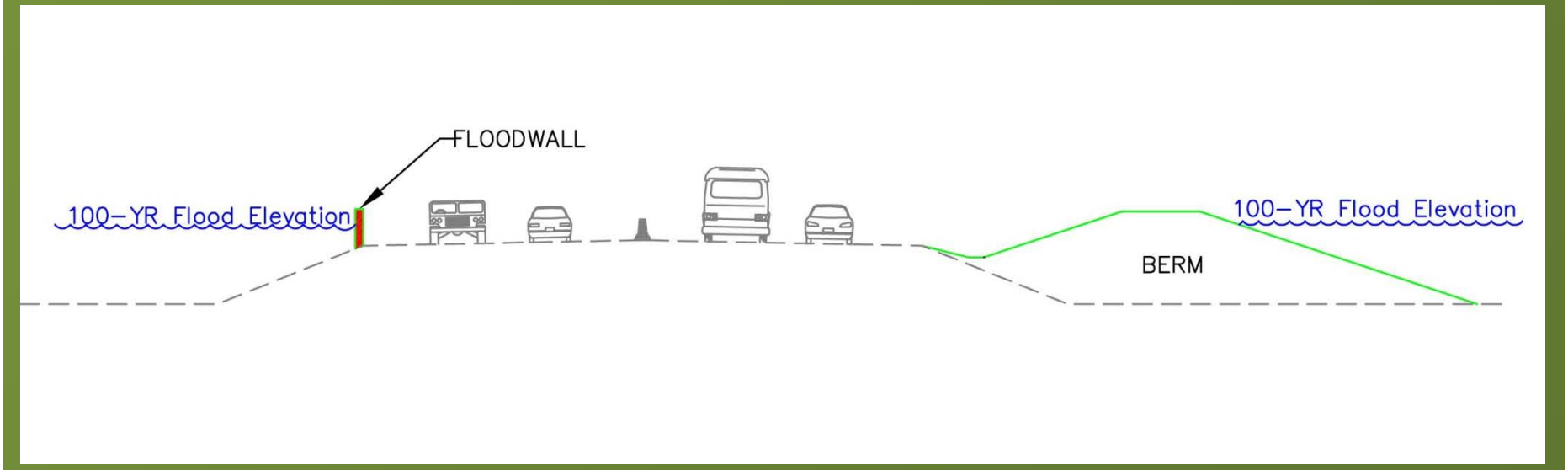
Protecting I-5: Walls and Levees



Protect I-5 with walls and levees

Approach

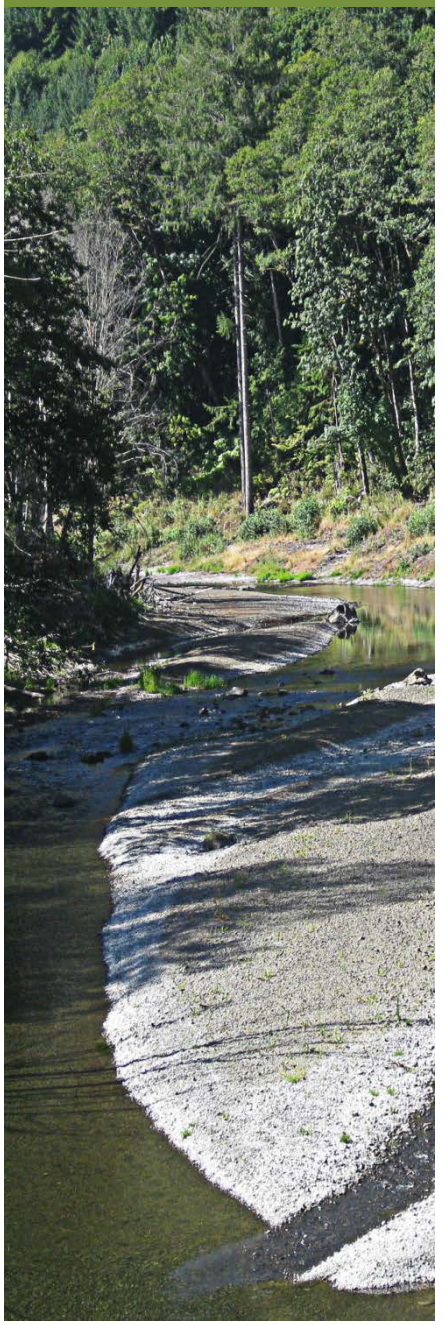
- Design Concept for Walls
  - Install at edge of pavement
  - Use to avoid impacts
- Design Concept for Berms
  - Use where adjacent ground is not too high
  - Use to develop storm water treatment areas



I-5 Damage Reduced/Cost

- Damage reduced $100M
- Cost $109M
- I-5 not closed during 100 year flood event.

Floodproofing

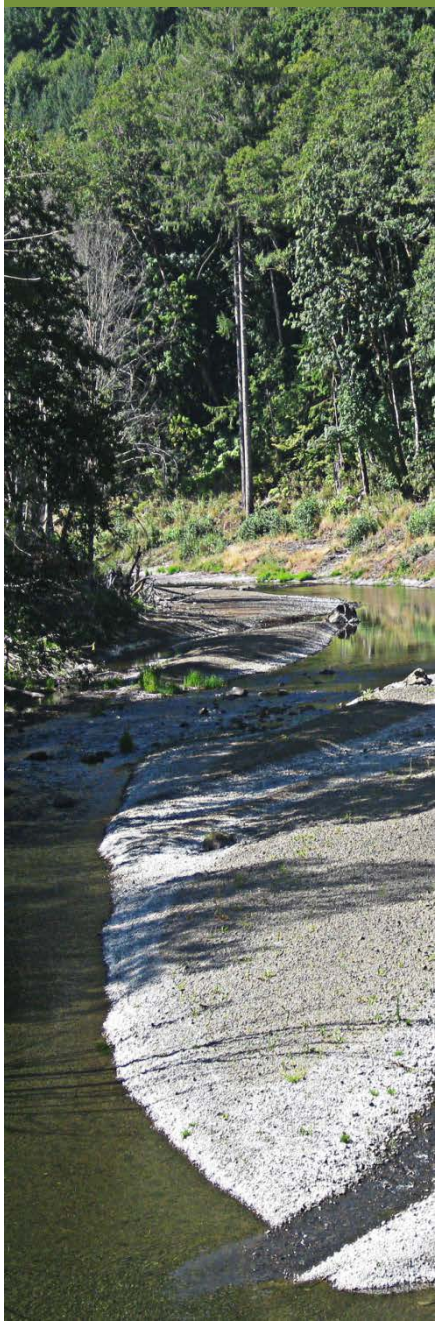


Structure Database

Floodproofing Costs (100 Year Event)

- 9,087 Structures Evaluated
- Benefit $150M
- Cost $90M

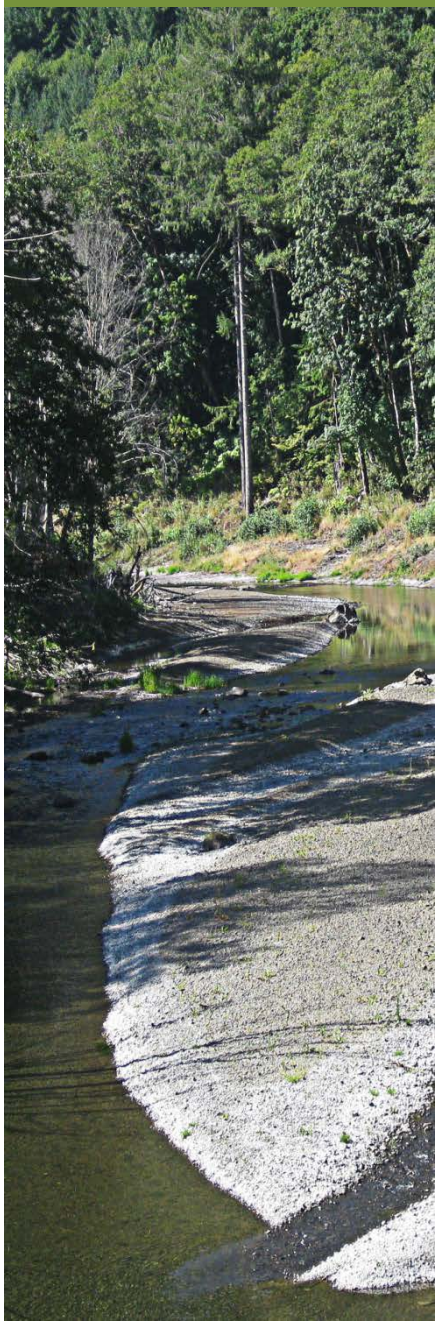
Land Use Management



Land Use Changes

- Prevent increase in damage
- Increase protection of natural functions
- Improve mapping
- Provide technical assistance to local governments

Water Retention



Objectives for Operation of Potential Dam

- Provide flood reduction in downstream areas
- Minimize fish and downstream environmental impacts
- Multi-purpose dam store water during winter and release during summer for fisheries and water quality enhancement

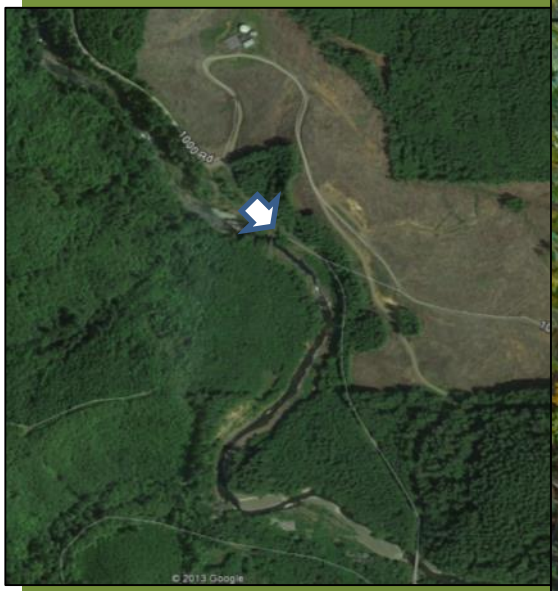
Water Retention Structure Options Selected for Evaluation

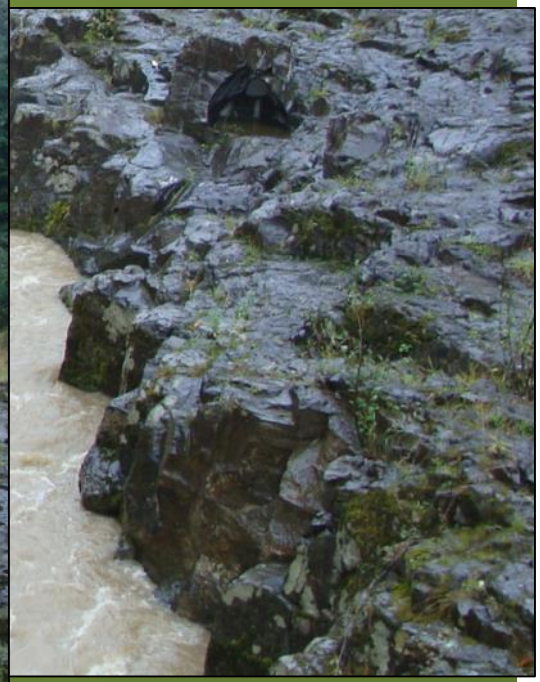
- Flood Retention RCC* Dam (FR-RCC)
- Multi-purpose RCC Dam (MP-RCC)
- Multi-purpose Rockfill Dam (MP-Rockfill)

*Roller Compacted Concrete (RCC)

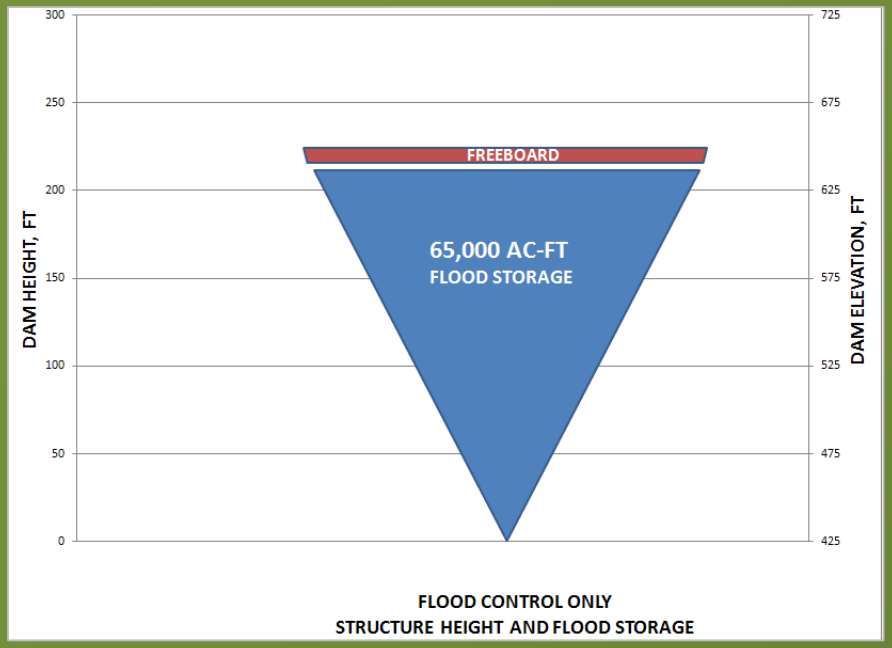
Dam Site

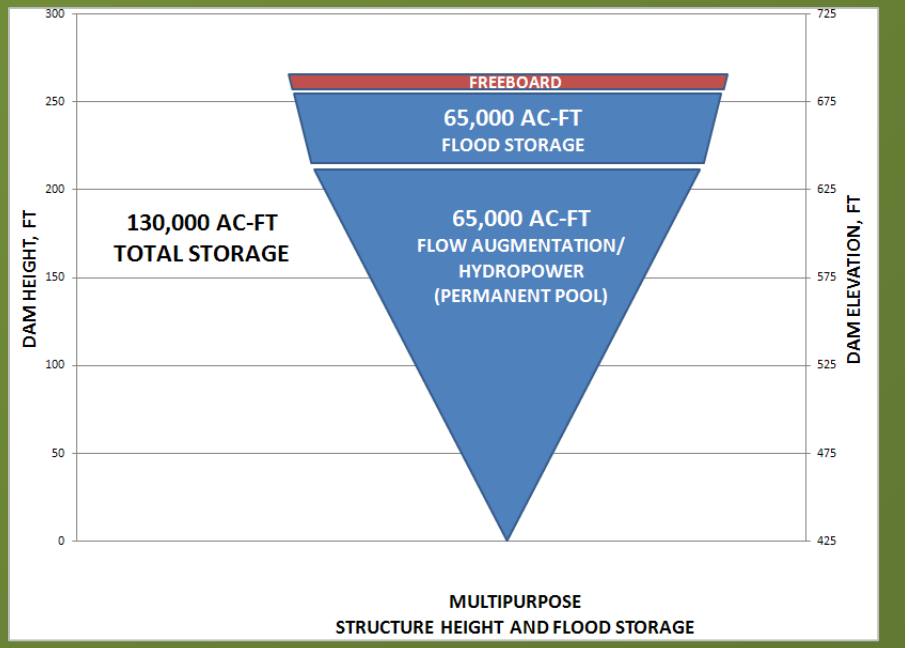
September 30, 2013





Basis of Design – Key Assumptions





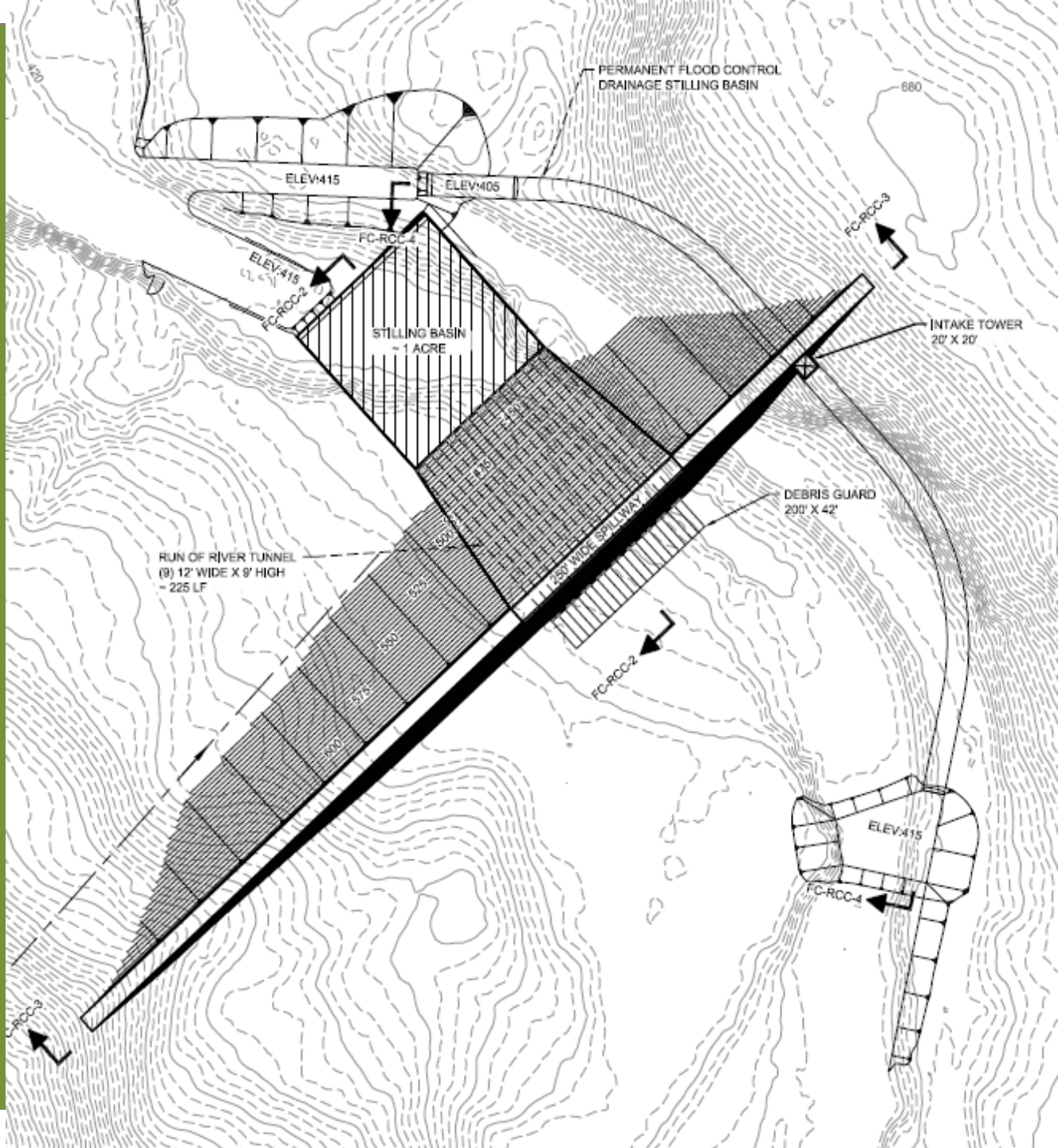
Flood Retention Crest Elevation: 654

Multi-purpose Crest Elevation: 714

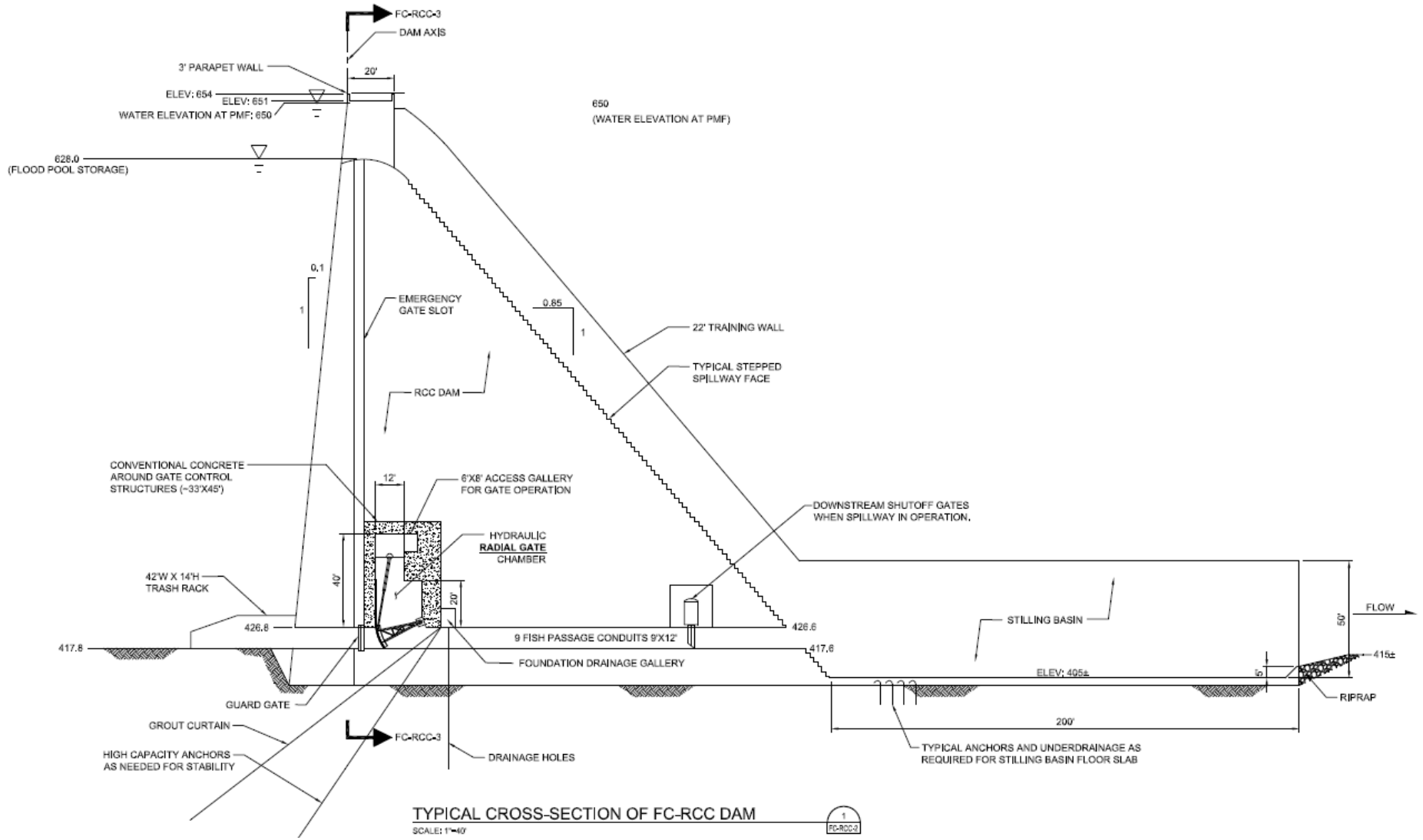
Flood Retention Reservoir Overview

- Dam Height = 227’
- Spillway Crest Elev. = 628
- Area = 860 Acres
- River Inundation Length = 6.8 mi

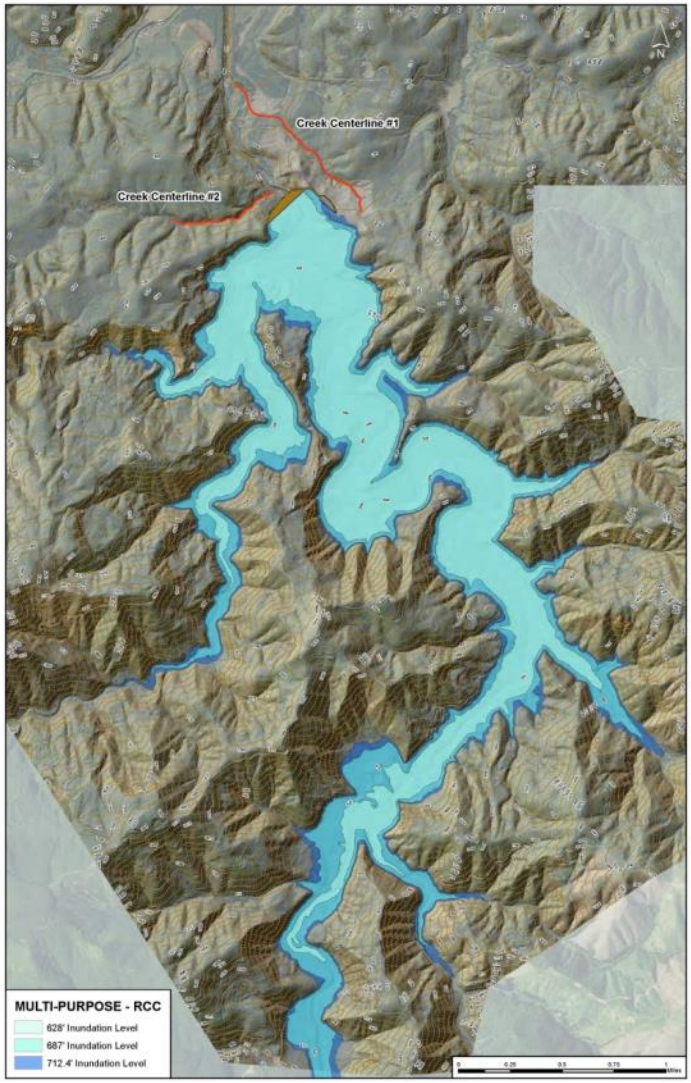
Flood Retention Only RCC Dam



Flood Retention RCC

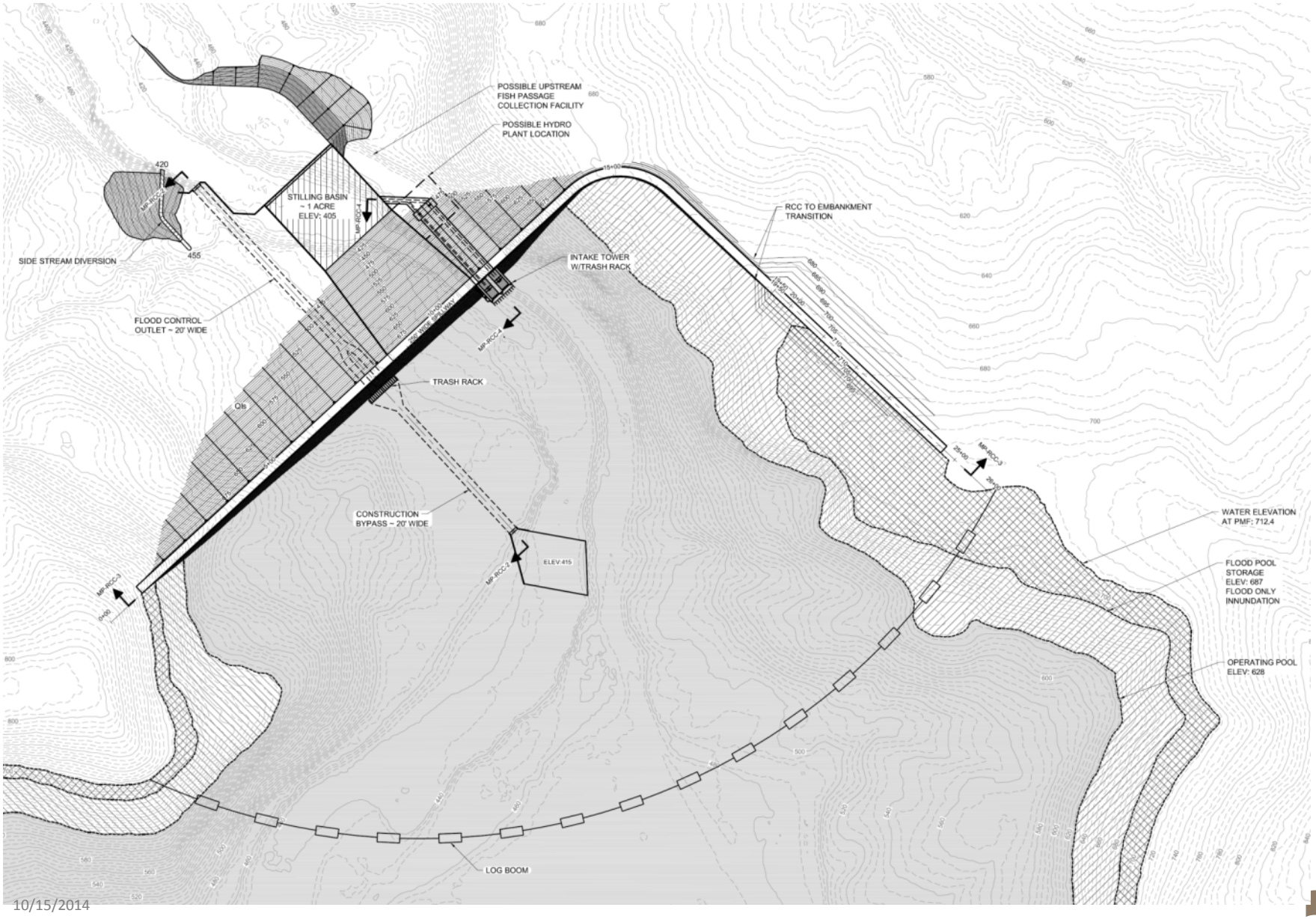


Multi-purpose Reservoir Overview



- Dam Height = 287’
- Spillway Crest El. = 687
- Area = 1,307 Ac
- River Inundation Length = 7.5 mi

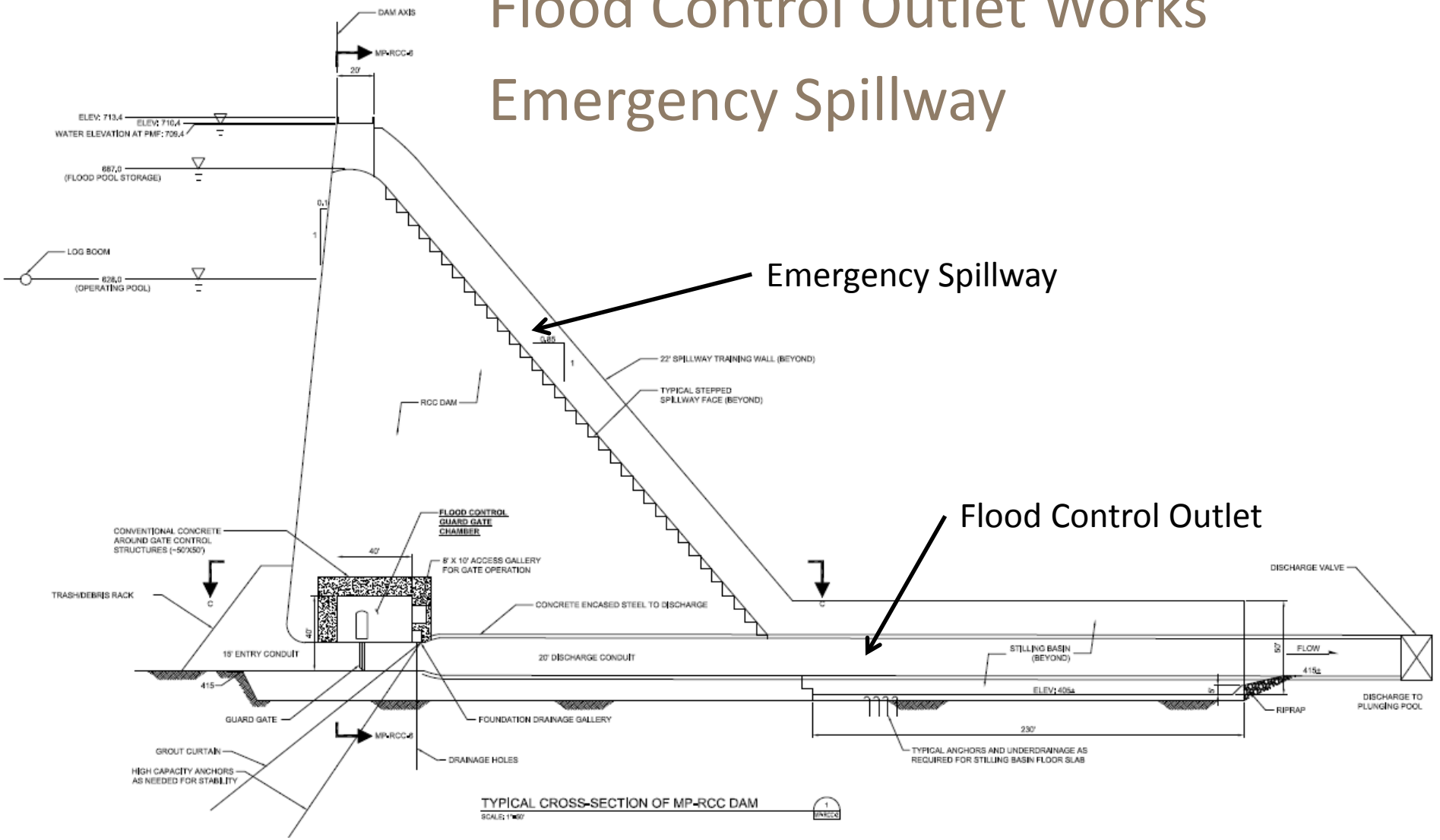
Multi-purpose RCC Dam



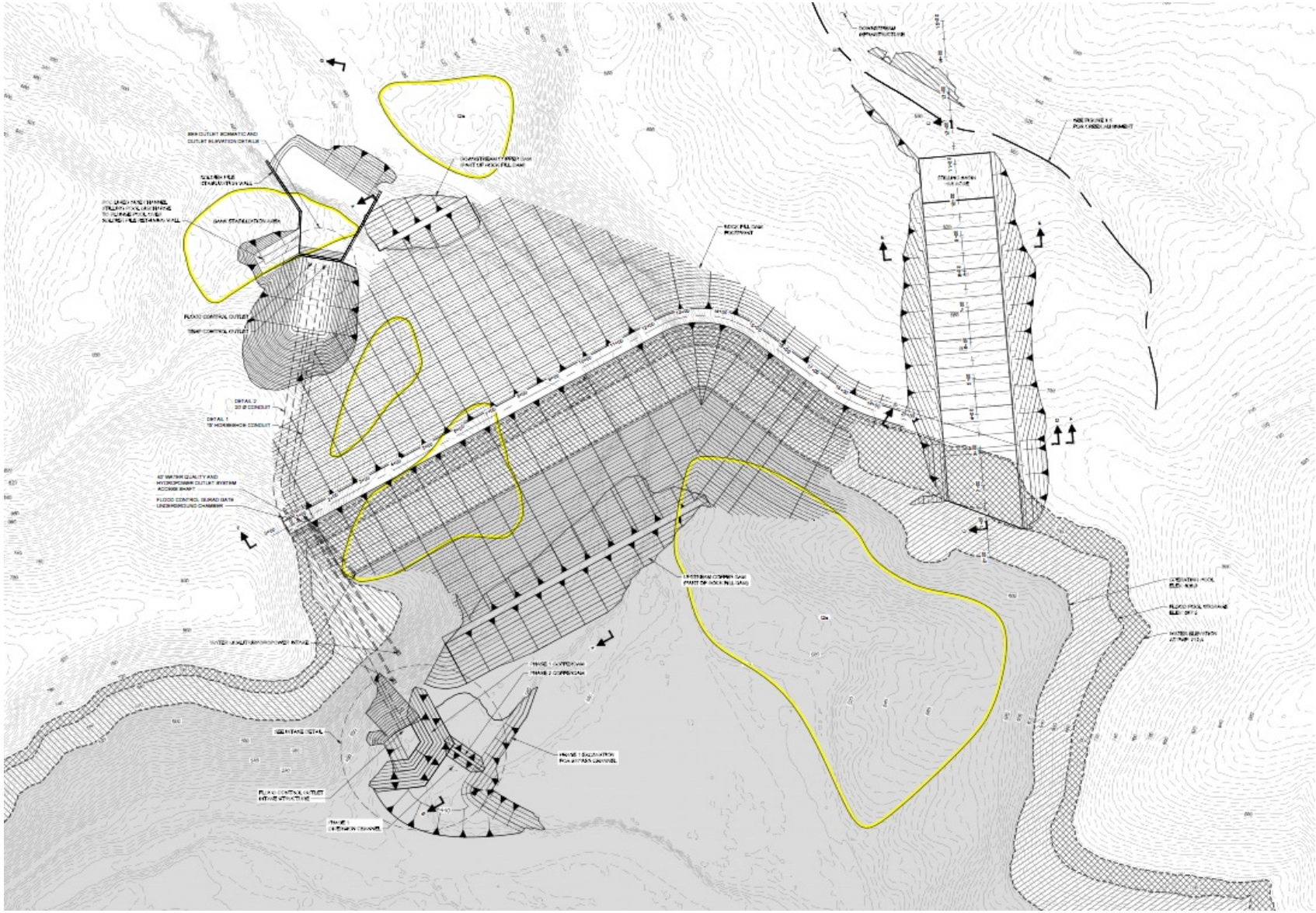
Multi-purpose RCC

Flood Control Outlet Works

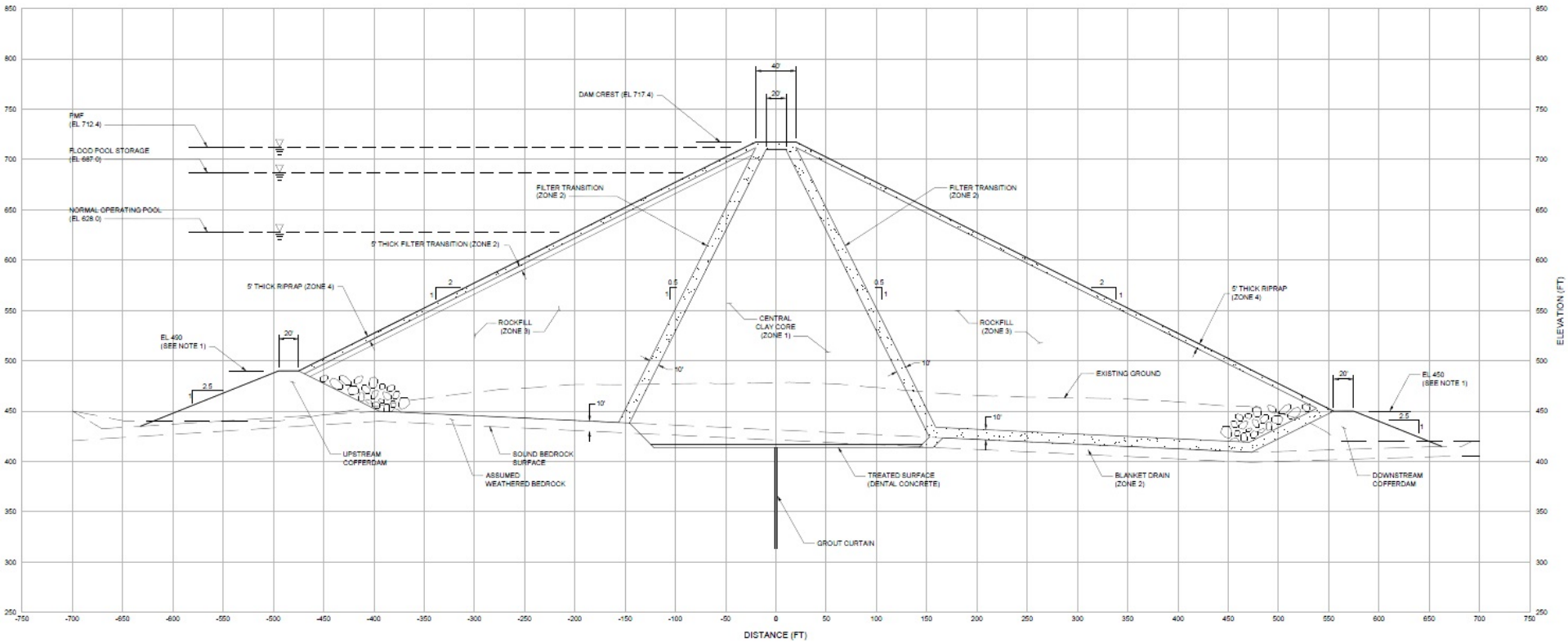
Emergency Spillway



Multi-purpose Rockfill Dam



Multi-purpose Rockfill Dam Section



Climate Change Flood Retention Scenarios

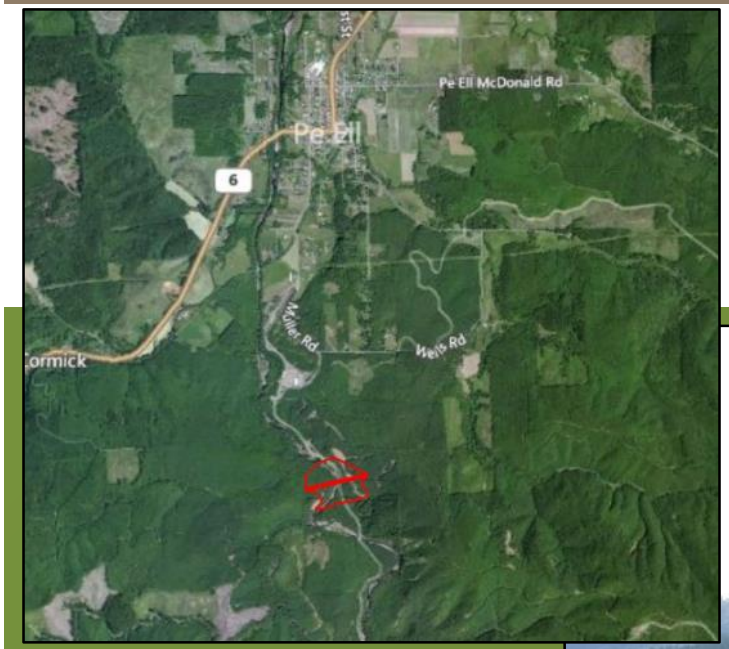
Scenario 1

- 18 percent increase in Chehalis River flows
- 10,000 AF increase in flood retention storage – to 75,000 AF
- Increase in dam height 9 feet to 239 feet

Scenario 2

- 90 percent increase in Chehalis River flows
- 65,000 AF increase in flood retention storage – to 130,000 AF
- Increase dam height 57 feet to 287 feet
- The same height as the non-climate change MP dam

Dam Site


Pe Ell McDonald Rd
Pe Ell
6
Miller Rd
Wells Rd
ormick


Approx. Dam Crest

Dam Design Rules

- Washington State Department of Ecology
  - Dam Safety Office Involved throughout project
  - Dam Safety Guidelines
    - Provide design and construction criteria
    - Stricter criteria for large, high hazard dams
- Federal Standards
- U.S. Commission on Large Dams guidelines

Dam Design Criteria

- Washington State Department of Ecology
  - Dam Safety Office Involved throughout project
  - Dam Safety Guidelines
    - Provide design and construction criteria
    - Stricter criteria for large, high hazard dams
- Federal Standards
  - U.S. Army Corps of Engineers
  - U.S. Bureau of Reclamation
  - FERC

Dam Design Criteria

- Factors Considered
  - Dam size/Hazard classification: Large/High
  - Reservoir operation:
    - Permanent or seasonal pool: Multi-purpose dam
    - Intermittent operation: Flood control only
- Extreme Floods
  - Spillway designed to handle Probable Maximum Flood (1 in 10,000 year or greater event)
  - Construction flood protection by risk analysis
- Earthquakes
  - Dam and facilities designed for Maximum Credible Earthquake (1 in 10,000 year or greater event)
- Warning and Planning
  - Warning system will be installed and evacuation plans prepared and practiced

Dams in the US

- Last 25 years
  - More than 8,900 new dams built
  - More than 1,500 dams modified

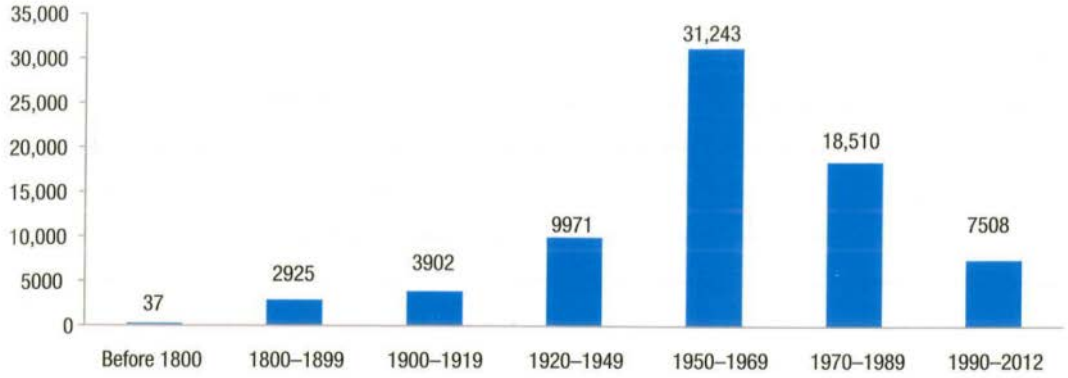


Figure 8. Dams constructed in the United States by completion date

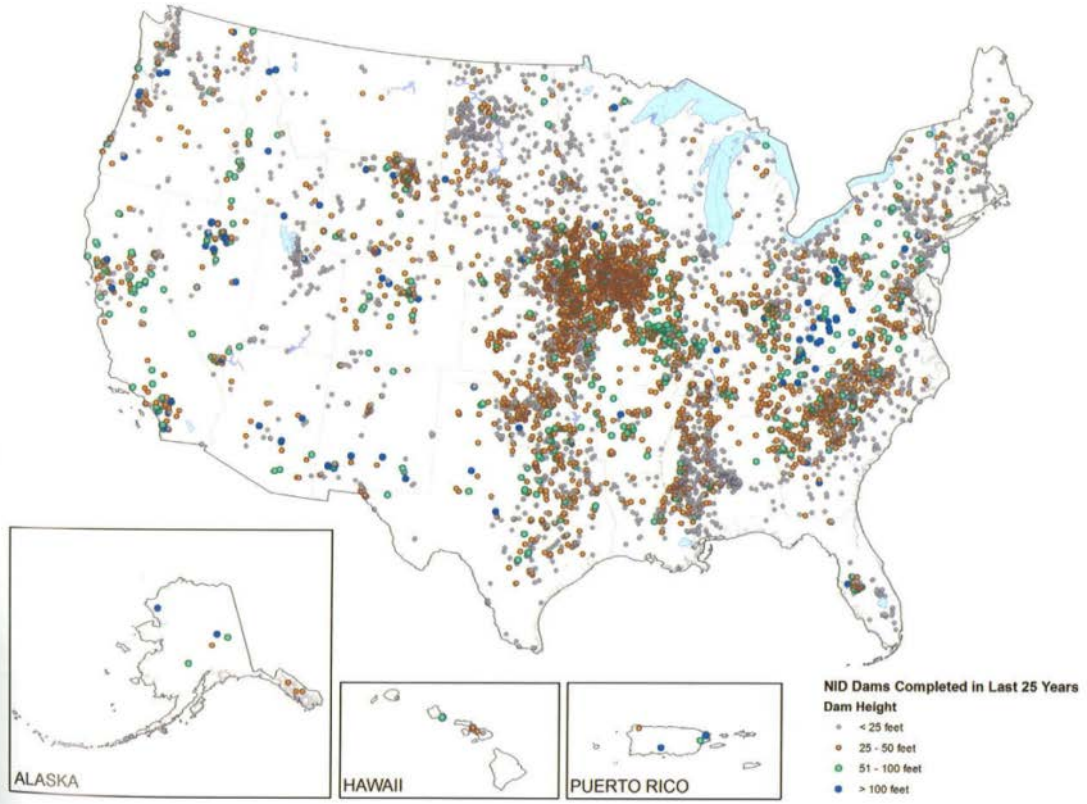


Figure 9. Dams constructed in the United States in the last 25 years by dam height

Dams in the US

- For new dams:
  - 10% greater than 50’ high
  - 15% high hazard potential (HHP)
- HHP dams under construction in 2012:
  - 33 less than 50’
  - 16 between 50’ and 100’
  - 7 over 100‘

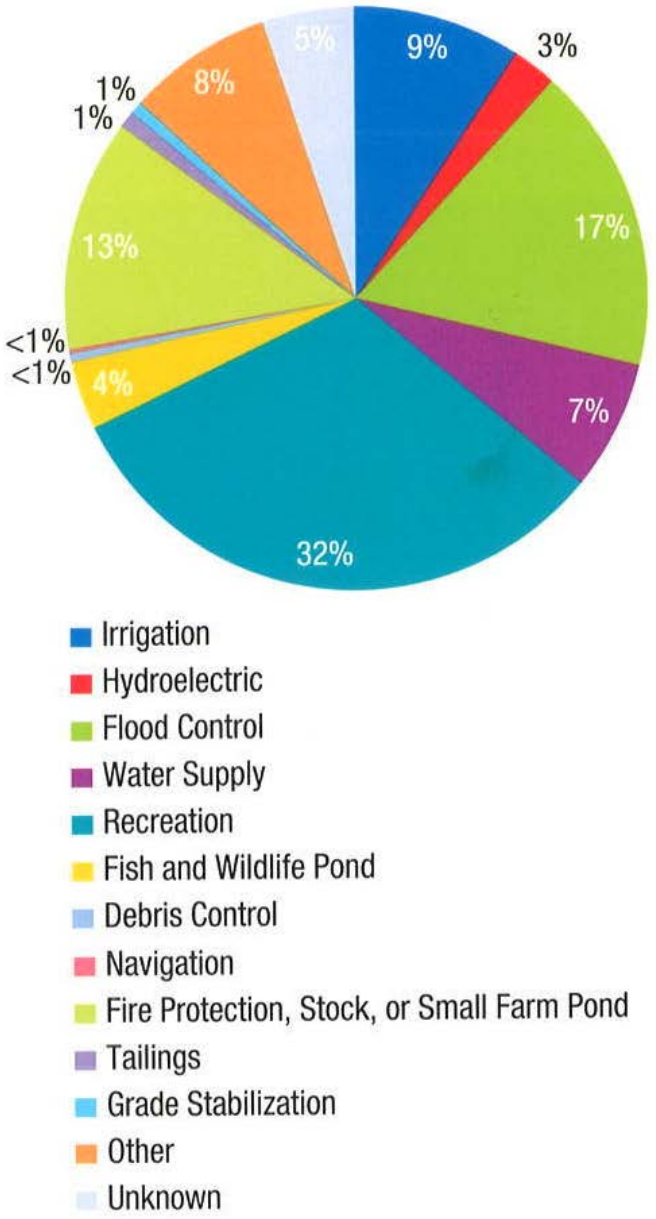
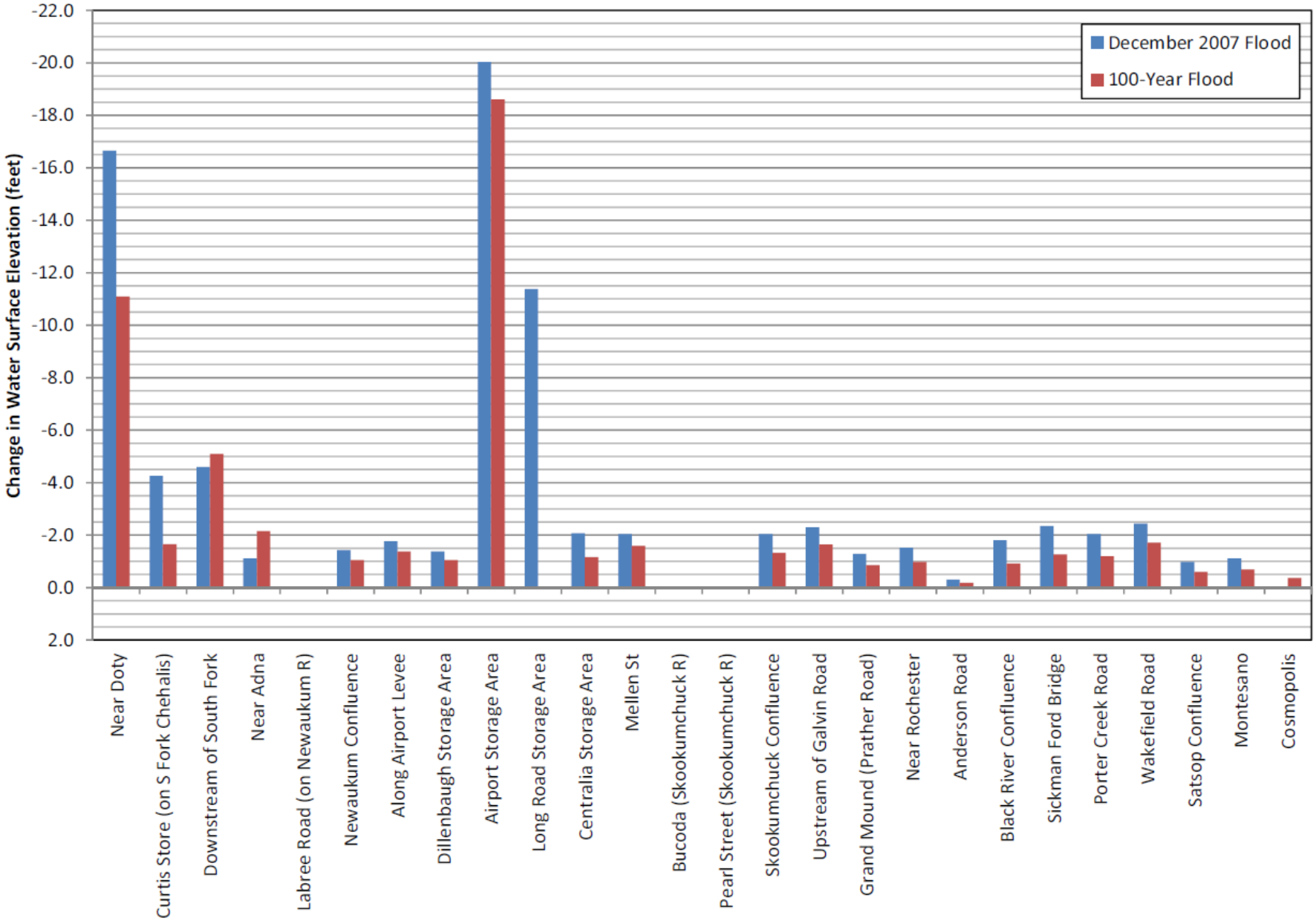
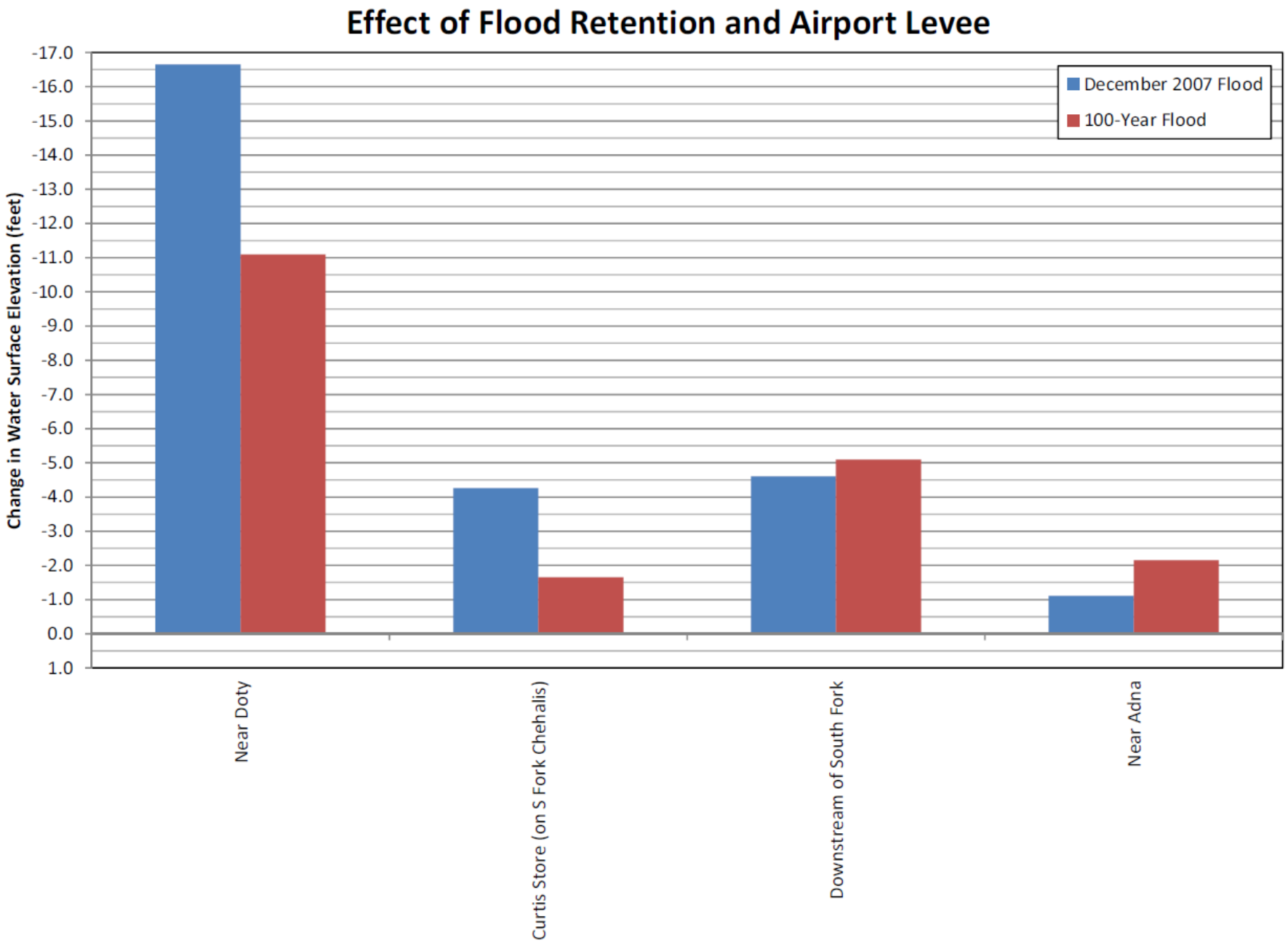


Figure 7. Distribution of U.S. dams by primary purpose

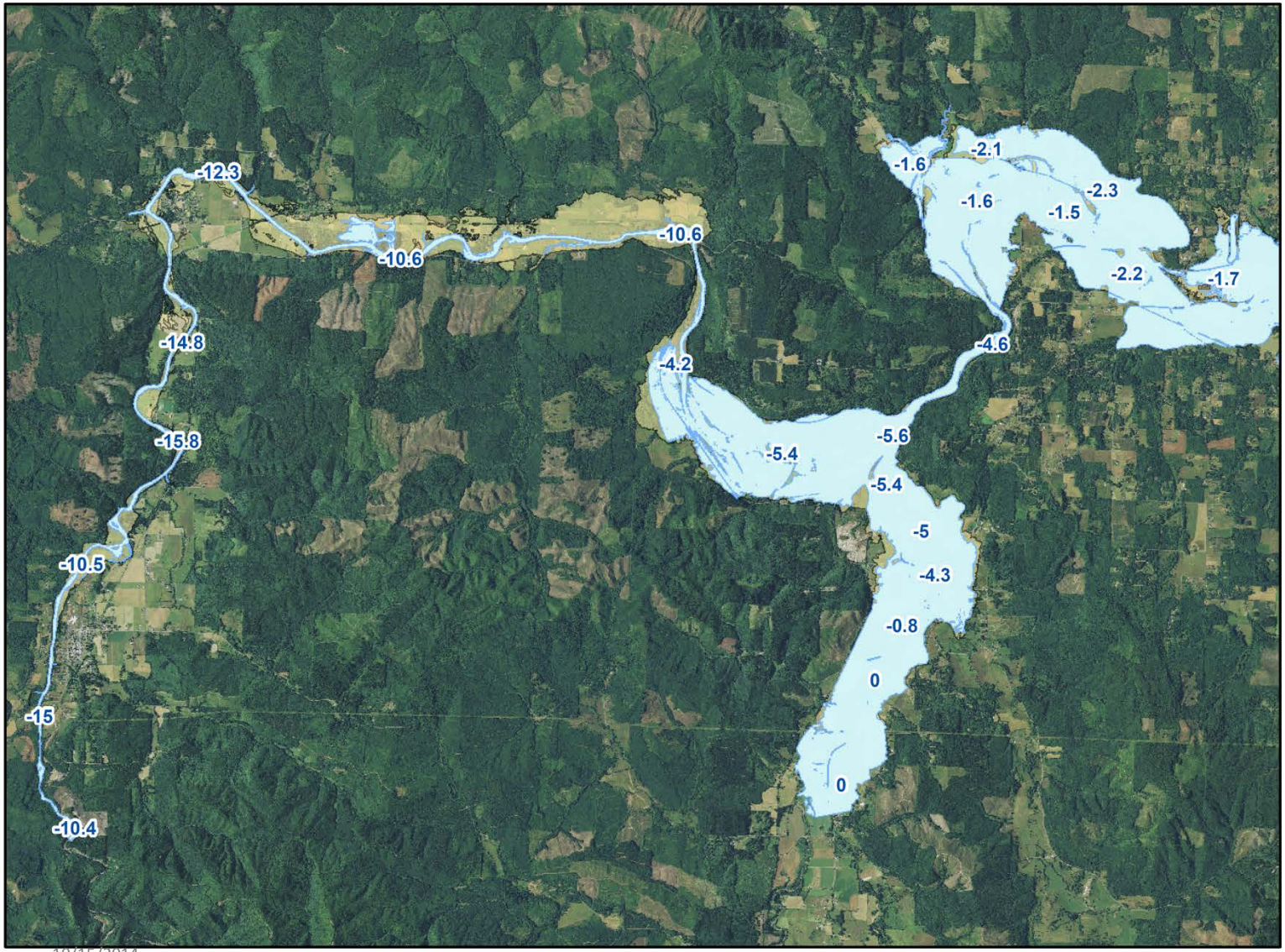
Effects of Potential Dam

Effect of Flood Retention and Airport Levee




Effect of Flood Retention and Airport Levee
Change in Water Surface Elevation (feet)
-17.0
-16.0
-15.0
-14.0
-13.0
-12.0
-11.0
-10.0
-9.0
-8.0
-7.0
-6.0
-5.0
-4.0
-3.0
-2.0
-1.0
0.0
1.0
December 2007 Flood
100-Year Flood
Near Doty
Curtis Store (on S Fork Chehalis)
Downstream of South Fork
Near Adna

December 2007 – Pe Ell to Adna



Summary of Flood Reduction Benefits

- Used 1 percent of time based on historic record.
- Reduces flows by ~15% for 10-100 year.
- 100 year to 40 year event, 1.5 feet lower in Centralia, 0.5 lower in Montesano.
- I-5 closed less frequent and for less time
- Multi-purpose increases summer low flows by factor of 3-6.

Changes in Fish Populations – Water Retention Structures

Species	% Change in Fish Population with FRO50
Spring Chinook	-8.1%
Fall Chinook	-1.1%
Steelhead	-4.0%
Coho	-1.9%
Total	**-2.1%**

Changes in Salmon Populations – Restoration and Water Retention

Low Restoration	High Restoration	Dam + Low Restoration	Dam + High Restoration
20.1%	54.8%	13.7%	41.9%

Other Species

- Response varied with species
- Much more data is needed to determine in-channel effects on Other Fish and Non-Fish species

Water Retention Damage Reduced/Cost

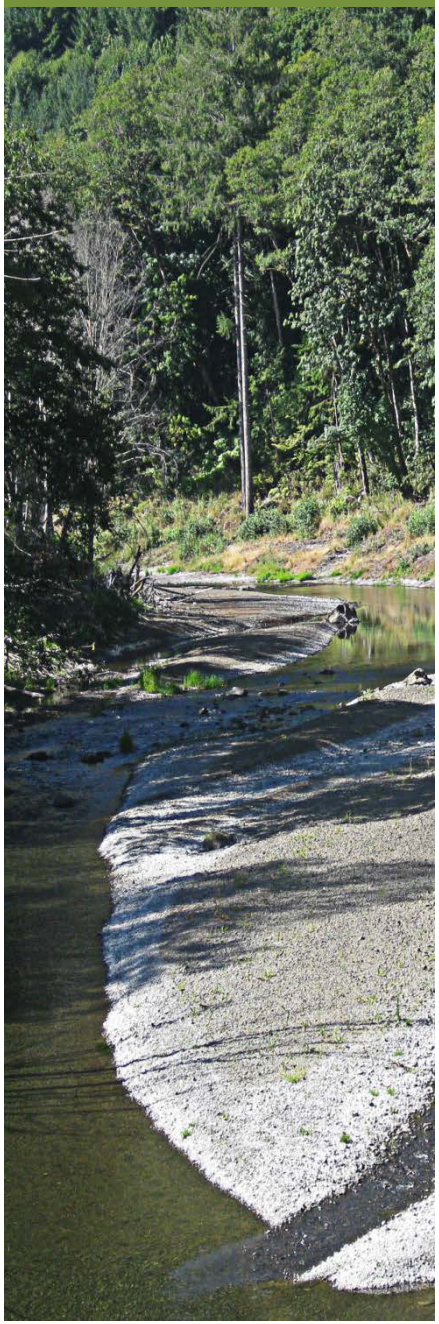
100 year estimates

- Damage reduced $600M
- Flood Retention Only Dam Cost $300M
- Multi-purpose Dam Cost $400M

Next Steps

- Work Group develops recommendation
- Governor and Legislature decide on funding
- Permit process, public review and additional analysis.

Combination of Actions



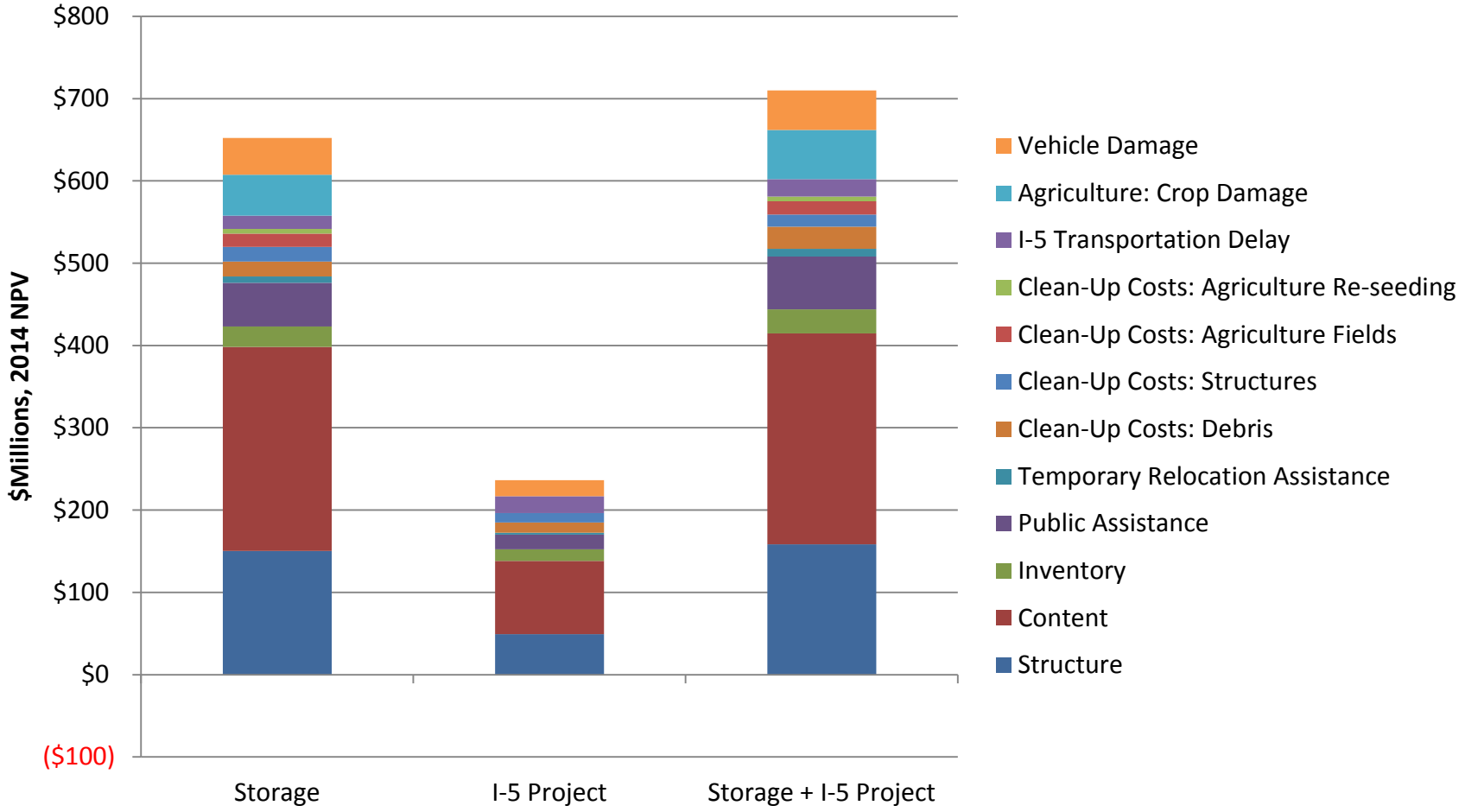
Alternatives Under Consideration

- Water retention, floodproofing, habitat restoration
- I-5, floodproofing, habitat restoration
- Water retention, I-5, floodproofing, habitat restoration

*Small projects would be part of each alternative

Summary of Benefits

Expected Project Alternative 100-Year Net Present Value ($2014)



Major Conclusions

- The basin is important for diversity of aquatic and semi aquatic species, most notably salmon and steelhead, mud minnow, and Oregon spotted frog.
- Climate change is a factor – the magnitude is uncertain
- The basin has gone decades without much attention, an immense amount of restoration is needed to recover, and it will have to be effective and extensive to overcome background degradation.
- Much work ahead to lay the ground work for restoration to be effective.

Major Conclusions

- Floodproofing cost effective but insufficient by itself.
- All dam options negatively impact fish and wildlife.
- Flood Retention only dam cost effective but impacts need to be offset.
- I-5 walls are not cost effective.
- Combination of dam, floodproofing and restoration is cost effective.
- Flood damage is not eliminated.
- Sequencing of actions is critical to achieve the predicted results.

Next Steps

- Work Group Recommendations to Governor mid-November
- Governor Next Biennium Budget – December
- Legislature Decision – June 2015

More Information

- http://ruckelshauscenter.wsu.edu/ChehalisFlooding.html
- https://www.ezview.wa.gov/chehalisfloodauthority

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Your Questions and Comments

I-5 Under Water
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